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Response of growth and production of rice varieties caused by application amendment straw Bokashi and specific location of fertilization in salin soil

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Abstract. Efforts to improve rice tolerance to salt stress conditions to obtain salinity tolerant varieties can be done through adaptation of anatomy and morphology. Research was conducted in Paluh Ketuk, Kecamatan Percut Sei Tuan. The experiment was using factorial randomized block design with two factors. The first factor is Amendment (A) consists of 4 degrees: 0 t/ha, 4 t/ha, 8 t/ha and 12 t/ha. The second factor is the Varieties (V) consists of 6 kinds: Ciherang, Bestari, Inpari 4, Mekongga, Inpari 13 and Cibogo. The variables are: leaf area, number of tillers, number of productive tillers, number of grains per panicle, number of chlorophyll, 1000 grain weight and grain weight/ plot. Data were analyzed by F test and Duncan Multiple Range Test (DMRT), further analysis by response curve. The yield of higher in order are Bestari, Ciherang and Mekongga. Compost treatments were significant in variable of leaf area and grain weight per plot. Whereas the varieties treatments were significant on number of tillers, number of productive tillers, number of grains per panic and grain weight per plot. Combination treatments of compost and varieties were significant on grain weight per plot. Rice varieties suggested are Bestari, Ciherang and Mekongga its tend to have better resistance to higher grain yield than other varieties.

Keywords**:** genetic, compost, varieties, salinity

Introduction

Need for food especially rice will increase along with the increasing number of residents. Increased rice production can be done by giving input intensification of agriculture through integrated crop management, especially on marginal lands such as use of salinity stress tolerant varieties in saline land, balanced fertilizer use and addition of organic matter and microbial use of phosphate solvent which is one alternative to improve P fertilizer efficiency and increase the solubility of P, as a biological fertilizer is easily updated and introduced.

Decline in rice production problems in addition to the narrowing of land cultivation, according to US-EPA (2009), also a decline in soil fertility due to salinization. This can lead to an increase in the salinity of agricultural land due to salt deposits resulting in lower levels of soil fertility. One of the efforts is to restore soil fertility by adding organic material to be applied to lands that fertility begins to decrease to improve land productivity and efficiency of fertilizer absorption and preserve the resources of the land.

This research aims to obtain salinity tolerant varieties through anatomical and morphological adaptation in salt stress conditions, that capable to get high production with good quality through integrated crop management technologies. The land as a research location in Paluh Ketuk has classified as saline soils.

Salinity stress affects plant growth in two ways: by increasing the ion concentration around the roots and accumulation of Na^+ in cells and tissues. Effect of osmotic pressure increase will be seen in the growth and development of leaves due to disruption of elongation and cell division, while the influence of Na^+ toxicity is evident in the increasing number of wilted leaves (Munns and Tester, 2008). Beneficial effect of salt acclimatization according to Pandolfi, *et. al.* (2012) is evidence of deficiency prevention of K^+ and Na^+ accumulation, especially in the roots, suggesting that the physiological processes have a major role.

Phosphate fertilizers are its used directly, have low solubility generally compared to chemical fertilizers, so we need an attempt to increase its solubility such as the use of microorganisms and organic matter. According to Noor's research (2003) on soybean plants, there was a significant interaction between phosphate and phosphate solvent combination of bacteria and manure to the plant dry weight at age 6 week after planting.

Materials and Methods

The experiment was conducted in Paluh Ketuk, Desa Tanjung Rejo Kecamatan Percut Sei Tuan, started in April-September 2012 in the saline soil at 1.5 m height above sea level with flat topography. The materials: straw compost + Rhiphosant (solvent bacterial phosphate), seeds Ciherang, Bestari, Inpari 4, Mekongga, Inpari 13 and Cibogo. Phonska 15:15:15 NPK compound fertilizer, water, herbicides, fungicides, insecticides, PPC Atonik, Growmore. The tools: razor blades, hoes, waterpot, labels, stationery, plastic, pail, sprayer solo, chopper, analytical balance, oven, laboratorium and others.

The design used was a randomized block design (RBD) with 2 factors. The first factor is the straw compost amendment (A) consists of 4 treatment levels are: A0 = 0 t/ha, A1 = 4 t / ha ≈ 2.4 kg / plot, A2 = 8 t / ha ≈ 4.8 kg/plot and A3 = 12 t / ha ≈ 7.2 kg/plot straw compost. The second factor is the varietis (V) consists of 6 varieties: V_1 = Ciherang, V_2 = Bestari, V_3 = Inpari 4, V_4= Mekongga, V_5 = Inpari 13, and V_6 = Cibogo. Each treatment was replicated three times. The data were analyzed by the F test and followed by Duncan's Multiple Range Test (DMRT) and response curve to determine the optimum dose straw compost on saline soil. The Variables observed were: leaf area, number of tillers, number of productive tillers, number of grains per panicle, number of chlorophyll, 1000 grain weight and grain weight/ plot.

Results and Discussion

Results of analysis of variance in Table 1, shows that the compost is applied to give real effect on leaf area and grain weight per plot.

Table 1. Analisys of Varians Leaf Area, Number of Chlorophyll, Number of Tillers, Number of Productive Tillers, Number of Grains per Panicle, 1000 Grain Weight and Grain Weight/ plot caused by Straw Compost Treatment (tons / ha)

Treatments		Leaf Area (cm)	Number of Chlorophyll (grain /6mm^2)	Number of Tillers (stem)	Number of Productive Tillers (stem)	Number of Grains per Panicle (grain)	1000 Grain Weight (g)	Grain Weight/ plot (g)
Straw Compost (ton/ha)	0	34,47c	42,18 a	36.25a	31,92a	123,43a	22,17a	2.730,04b
	4	37,56bc	41,10 a	35.50a	32,11a	121,66a	23,28a	2.774,09ab
	8	40,04ab	41,54 a	37.50a	33,36a	123,29a	22,36a	2.853,07ab
	12	42,98a	40,45 a	36.75a	32,25a	122,26a	23,56a	3.004,31a

Note: The numbers are not followed by the same letter in the same column or row, showed significantly different at 5% level by Duncan's Multiple Range Test.

Compost gave significant effect on leaf area and grain weight per plot. Where the straw application of 8 tonnes per ha significant to leaf area than application of 4 tonness/ ha and 0 tonnes/ha. Grain weight significantly higher in straw compost application at 12 tonnes/ha compared with those not given straw compost.

According to Arafah, (2003), approximately 80% of potassium its absorbed by plants be in the hay, straw use as a source of potassium tends to be more effective. The addition of straw compost also improves soil structure and aeration, increase microbial activity and increase the availability of nutrients in the soil.

Based on the results of the data are shown in Table 2, there were three varieties with the highest yield in the order of production, namely: Bestari, Ciherang and Mekongga.

Table 2. Analisys of Varians Leaf Area, Number of Chlorophyll, Number of Tillers, Number of Productive Tillers, Number of Grains per Panicle, 1000 Grain Weight and Grain Weight/ plot caused by Varieties Treatment.

Treatments		Leaf Area (cm)	Number of Chlorophyll (grain /6mm^2)	Number of Tillers (stem)	Number of Productive Tillers (stem)	Number of Grains per Panicle (grain)	1000 Grains Weight (g)	Grains Weight/ plot (g)
Varieties (V)	**ng (V_1)**	38,68a	40,68a	34,25ab	30,00bc	126,67b	**23,38a**	2.867,84a
	Bestari (V_2)	39,10a	40,99a	38,63a	33,63ab	119,40bc	22,58a	**2.932,16a**
	Inpari 4 (V_3)	37,72a	40,63a	**40,04a**	**36,17a**	112,29c	23,00a	2.854,42a
	gga (V_4)	37,87a	41,85a	37,46a	32,50ab	120,14bc	22,13a	2.865,24a
	13 (V_5)	**40,84a**	41,89a	30,29b	28,25c	**143,17a**	23,08a	2.751,16b
	Cibogo (V_6)	38,36a	41,85a	38,33a	33,92ab	114,30bc	22,88a	2.771,44b

Note: The numbers are not followed by the same letter in the same column or row, showed significantly different at 5% level by Duncan's Multiple Range Test

Treatment of varieties showed significant effect to number of tillers, number of productive tillers, number of grains per panicle and grain weight per plot. Number of tillers and productive tillers highest is Inpari 4 with average 40.04 stems and 36.17 stems. Number of grains per panicle owned by Inpari 13 with number of 143.17 grains/panicle. But the average weight of the highest grain owned by Bestari with number of grains 2932.16 g/plot.Plants are able to take advantage of Na^+ accumulation in the tissues, generally has a shorter plant height (Rahayu and Harjoso, 2010). In addition to a smaller leaf area during in the nursery, due to salt stress (Amirjani, 2010), also a decline in the number of stomata and cuticle layer thicker. Such opinions Eker, *et. al.* (2006) of the research results indicate that a higher salt tolerance in maize varieties based on leaf severity of symptoms associated with significantly lower concentrations of Na^+ in the canopy.

High salinity levels, in the opinion of Yaghoubian, *et. al*. (2012), cause number of leaves and leaf area decreased faster than the number of tillers. Furthermore, according to

Ali, *et. al*. (2004), that the results of planting, chlorophyll content, panicle length and number of productive tillers will decrease due to salt stress.

Combined treatment of straw compost and varieties give real effect on grain weight per plot, where the Mekongga grains was significantly higher weights than Inpari 13 and Cibogo on treatment without compost. Based on the results of the data analysis are shown in Table 3, weight of grain per plot its caused by compost treatment and variety (AxV) at harvest.

Table 3. Analisys of Varians Grain Weight per plot (g / plot) caused by Amendment and Varieties (AxV) Treatment at Harvest

	Without Compost (K_0)	Straw Compost 4 ton/ha (K_1)	Straw Compost 8 ton/ha (K_2)	Straw Compost 12 ton/ha (K_3)	Avg V
Ciherang (V_1)	2.759,47 ab	**2.940,71 ab**	2.561,24 ab	**3.209,96 a**	2.867,84 a
Bestari (V_2)	2.776,18 ab	2.866,40 ab	**3.055,82 ab**	3.030,22 ab	**2.932,16 a**
Inpari 4 (V_3)	**2.910,93 ab**	2.744,98 ab	2.857,96 ab	2.903,82 ab	2.854,42 a
Mekongga (V_4)	3.106,13 a	2.598,22 ab	2.829,69 ab	2.926,93 ab	2.865,24 a
Inpari 13 (V_5)	2.419,02 b	2.870,04 ab	2.779,20 ab	2.936,36 ab	2.751,16 b
Cibogo (V_6)	2.408,53 b	2.624,18 ab	3.034,49 ab	3.018,58 ab	2.771,44 b
Avg V	**2.730,04b**	**2.774,09 ab**	**2.853,07 ab**	**3.004,31 a**	

Note: The numbers are not followed by the same letter in the same column or row, showed significantly different at 5% level by Duncan's Multiple Range Test.

Based on the analysis of data obtained by averaging the highest yield varieties Bestari with weight 2932.16 g/plot. Composting at 4-12 tonnes/ha of grain weight obtained the same for all varieties tested, and varieties that are able to get the highest yield is Ciherang 3.209.96 g/plot with composting 12 tonnes/ha.

Grain weight is determined by the number of grains per panicle, grain weight and number of productive tillers, this is in accordance with the opinion of Zahrah (2011) as biologically, bokashi fertilizer can increase the activity of soil microorganisms that nutrient available to the plant to support the growth of plants such as the number of productive tillers. Shereen, *et. al.* (2005) in his study mentioned that testing inbred lines tolerant rice breeding is more likely to decline production, such as the number of tillers and number of panicles were significantly decreased due to salinity.

Conclusions

Composting application were significant to leaf area and grain weight per plot, which is increasingly increase the number of composting will increase leaf area and grain weight. Treatment of varieties are significant in the number of tillers, number of productive tillers, number of grains permalai and grain weight per plot. Average the highest yield obtained Bestari varieties of 2932.16 g / plot equivalent to 7,330 ton/ ha.

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